MASTER'S THESIS

Coevolutionary IS Alignment & The impact on Dynamic Capabilities in the public sector

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Abstract

Business and IT alignment (BITA) is an increasingly important topic. Co-evolutionary IS alignment (COISA) not only focuses on this alignment and its alignment competencies but also incorporates other aspects such as alignment motivation and heterogenous interconnections between employees. In this paper, we performed a quantitative survey-based study to test the influence of COISA on Dynamic Capabilities. COISA was represented with three hypotheses, of which one was found statistically significant; The hypothesis that alignment competencies positively influence the degree of dynamic capabilities on organizations in the public sector was supported in this study. The moderating aspects of COISA, alignment motivation, and Heterogenous interconnections showed no statistical significance in our study. Data analyses were performed using the PLS-SEM technique with a sample size of 70.

Key terms

COISA, Alignment Competencies, Dynamic Capabilities, Alignment motivation, PLS-SEM

Summary

Large organizations increasingly find themselves in a chase to adapt to their surroundings and competitors. These rapid changes often require organizations to become so-called adaptive-enterprises. Meaning the organizations should have the ability to change according to their environment rapidly. This capability is also known in the literature as Dynamic Capabilities. Dynamic capabilities can be defined as a combination of procedures and processes, namely sensing, seizing, and reconfiguring. Public sector organizations, in particular, often fail in this process to become adaptive due to their complex context with often conflicting stakeholders. There are, however, clues in the literature that Dynamic capabilities might improve with better alignment between business and IT. (BITA) BITA is believed to be made possible through the utilization of 'Alignment Competencies.' Moreover, the literature suggested this influential relationship might further be emphasized through 'Alignment motivation' and 'Heterogeneous interconnections.'

This led to the following research question:
What is the impact of co-evolutionary IS alignment on the dynamic capability of complex organizations in the public sector?

Which was tested on three hypotheses:

H1 *The degree of alignment competencies has a positive effect on the dynamic capabilities of an organization.*

H2 *Alignment Motivation has a positive effect on the relationship between alignment competencies and Dynamic Capabilities*.

H3 '*Interconnections between heterogeneous employees' has a positive effect on the relationship between alignment competencies and Dynamic Capabilities.*

To test the above hypotheses, we conducted quantitative survey-based research. Initially, we had a goal of 100 to 120 usable responses. However, as the response rate was well below what we had anticipated, and we had a limited timeframe, we ended up with 70 responses after filtering data such as blanks. To test the hypotheses with a relatively low sample size, we utilized PLS-SEM. This method is suitable for low sample sizes, as for this specific research model, the minimum for PLS-SEM would be 60, which we surpassed by 16% with 70.

The PLS-SEM data analysis was performed using SmartPLS 3 and concluded a statistically significant relationship between 'Alignment competencies' and 'Dynamic Capabilities.' This forms supportive evidence for Hypotheses H1. However, For both hypotheses H2 and H3, no significant evidence was found, as their R values were below the .05 for significance.

These results indicate that organizations in the struggle to gain more dynamic capabilities should pay attention to alignment and alignment competencies. However, This paper focused on the public sector and was performed in one country in Europe with a limited sample size. The results may vary with other cultures or sectors, which further studies could establish. Furthermore, it remains research-worthy to establish the mechanisms and relationships between dynamic capabilities and alignment motivation or heterogenous interconnections. As while we could not establish evidence that these act as moderators on the relationship between alignment competencies and dynamic capabilities, the literature suggests there might be such a link. This difference might be due to the limitations of this study, or due differences in specific sectors or cultures. Quantitative studies with a different context or Qualitative research might give more in-depth insights into these mechanisms and remains a recommendation for further research.

Contents

1. Introduction

Ever since the adoption of IT and the growing dependence on IT, organizations are struggling to utilize the full IT potential. Precedent research on the cause of why organizations fail to utilize IT properly, even though IT-budgets are increasing, refers to this as a lack of alignment between business & IT (BITA) (E. Gerow et al., 2014; Wilkinson et al., 2006). This leaves organizations increasingly eager for ways to achieve a certain degree of business & IT alignment (BITA) (Kahre et al., 2007), but complex organizations often fail in the process. (Brynjolfsson & Hitt, 2000)

This is often contributed to their complexity. Complex organizations, such as government branches in the public sector, face an extra challenge in utilizing a certain degree of BITA: They are often large, yet have to adapt quickly to an ever-changing environment filled with potentially conflicting political views and demands. (S. Van der Elst et al., 2014) This results in the complicated situation of managing potentially colliding interests from both internal and external stakeholders in a large organization, while also attempting to adapt to the continuously changing environment. (Merali et al., 2012)

To successfully align business & IT in such complex organizations requires them to become so-called "adaptive enterprises" as adapting to the changes requires continuous effort. (Wilkinson et al., 2006) This ability to adapt rapidly is also referred to as a so-called 'dynamic capability.' (G. Winter, 2003; Siegfried P, Et al., 2012) On which Wilden et al. (2013, p86) concluded: "*the possession of dynamic capabilities is a necessary, but insufficient, condition to achieve superior performance."*

Dynamic capabilities can be seen as a combination of procedures and processes, namely sensing, seizing, and reconfiguring (Wilden et al., 2013). While these mechanisms have been studied elaborately (Teece, 2007), little is known about the dependence of dynamic capabilities on the organizational context. The research that is available suggests that the effectiveness of dynamic capabilities is found to be largely dependent on the context in which it is applied (Wilden et al., 2013). This leaves a gap in knowledge, which might hold the key to the reasons behind high fail rates in alignment for complex organizations, as found by Brynjolfssen & Hitt (2000).

Recent studies on this subject acknowledge the complexity and seek answers by the utilization of complex theory or complex adaptive systems principles (CAS) (Onix et al., 2017), Which eventually resulted in the theory of Co-evolutionary IS-alignment (COISA). COISA can be defined as "*Co-evolution between IS stakeholders within and between alignment competencies within and between strategic, architectural, and operational contexts under conditions enabling efficacious dynamics"* (Walraven, 2019a). Focusing on the simultaneous and continuous evolution in both IT- and business domain and the interaction between these domains. There are models based on COISA, such as the approach of Benbyae & McKelvey (2006), which focuses on three adjustment levels: individual, operational, and strategic. Or later models by Walraven et al. (2018), which is based on the theory of COISA as a continuous process and recognizes five distinct alignment processes. This later model recently led to the model on three alignment competencies; strategic, orchestrational, and operational with moderating enablers' Alignment motivation' and 'Interconnections.' (Walraven, 2019a)

Dynamic Capabilities can be seen as vital for success. (Wilden et al., 2013) And there are multiple studies that point out that dynamic capabilities improve with-, or depend on(It) alignment. (Siegfried P, Et al., 2012; Schwarz, Et al., 2010; Ya-Hui Lien, 2007, 2009) It thus stands to reason that COISA would have a relationship with Dynamic Capabilities. However, no studies were found that directly link the degree of COISA to the dynamic capabilities of an organization. There are, however, studies on alignment in the public sector that indicate that the social dimension in IT/IS alignment would be significant for overall alignment and effectiveness (Nigel et al., 2005). While that is not a study on COISA as a whole, the social dimensions in alignment can be seen as part of the enablers on alignment competencies found in COISA. This could indicate that alignment competencies indeed strongly rely on the 'social dimension' in order to gain dynamic capabilities successfully. This indication matches the latest model on COISA (Walraven, 2019a). It would thus be useful to verify whether this found connection translates to a form of COISA to understand further the mechanisms behind alignment and its impact on dynamic capabilities in the public sector. Furthermore, this research could be used to establish a broader context for the results of various case studies on the role of COISA in implementing an IT system at hospitals. This multiple case-study found that COISA was an excellent measure to map the interactions behind alignment, but was limited to specific implementations in only three organizations. (Walraven et al., 2019b) Research on the relation between COISA and Dynamic capabilities on a larger, quantitative scale would result in a better understanding of the mechanisms behind alignment for complex organizations in the public sector. Results then might contribute to lowering the fail-rates in reaching alignment and reducing the resources required to reach and maintain a certain degree of alignment through better understanding the conditions for dynamic capabilities.

In an attempt to establish more detailed knowledge on the potential influence of COISA and its relation to dynamic capabilities, this study aimed to establish what the impact of a certain degree of COISA is on the dynamic capabilities of complex organizations in the public sector. Such a link would indicate that more attention should be paid to the utilization of COISA and the mechanisms behind COISA. The existence of such a link would thus also stand ground for further research.

RQ: What is the impact of co-evolutionary IS alignment on the dynamic capability of complex organizations in the public sector?

In order to answer the research question, this study performed elaborate survey research. Selected stakeholders from large complex organizations in the public sector were asked to answer questions that determine the degree of COISA, which is applicable in their organizations as well as their present state of dynamic capabilities. Selecting these stakeholders was done based on their job description on social media such as Linkedin, ensuring enough knowledge on the topic and experience in their organizations. These specific respondents provided the data required for analyzing a potential correlation between COISA and dynamic capabilities and thus can indicate whether or not a significant, influential relationship exists.

2. Theoretical framework

2.1. Research approach

In order to find relevant sources, search queries were performed in either Ebsco Host or OU library. These are favored due to the more convenient filtering of peer-reviewed studies or searching in specific fields. The search was then based on keywords as well as forward / backward snowballing. Keywords were defined for all individual parts of the conceptual model of this paper. For example, 'Alignment motivation' and 'dynamic capabilities' were defined as keywords. Merely searching for keywords without specification of the field often resulted in long lists of hundreds or thousands of results. Thus, the decision was made to filter in specific fields. We established that the keywords had to be in the Title field, and if that still resulted in more than 20 results, an additional keyword was added to search in any field. If, however, this still would not reduce the list to be below 20, either additional keywords were used, or the location (title, abstract) was specified. 20 is an arbitrarily chosen number based on the simple fact that by default, EBSCO shows ten results per page, and two pages of results were deemed 'timely scannable.' Scanning results primarily focused on determining whether or not the keywords were used in the deemed context based on the abstract.

Furthermore, search queries were performed in Google Scholar, either because the title was known through snowballing or on specific terms that had a high chance of relevance. (For example, "Co-evolutionary IS alignment.")

Articles are searched based on title and abstract, with a focus on alignment or dynamic capabilities. Manual scanning was utilized to decide whether or not it was relevant enough, based on whether or not the article mentions co-evolutionary or social aspects, which could indicate similarity with the research question. (Saunders, 2015) Furthermore, Snowballing was used and made up for a large portion of the utilized sources.

Utilized search queries: (See for the full list and which sources came from which method appendix 2, origin of sources.)

EBSCOHost: Alignment (Title) + evolutionary(all) + public(all): 1 result.
Not used due: Lack of relevance due no focus on IT/IS alignment or the (co)evolutionary aspects. (Based on abstract)
EBSCOHost: Alignment(title) + interconnections(all) + IT (title): 0 results.
EBSCOHost: Alignment(title) + interconnection(title): 5 results.
(Title Combined:("IT alignment")) AND (interconnections): 1 result:
IT alignment strategies for customer relationship management, 2011
EBSCOHost: Alignment(title) + interconnections(title): 5 results.
EBSCOHost: Dynamic capabilities(title) + interconnections(title): 3 results.

2.2. Implementation

Of the research papers found through systematic query search or snowballing, 26 papers, and an online lecture were used as a source. See the reference list for all sources which are used for this paper. All sources found relevant on the previously discussed criteria were kept on a list, of which each item upon usage in this paper was added to the source list and reference list at the end of this article.

2.3. Results and conclusions – Theoretical Framework

Business & IT alignment (BITA)

In this research, IT/IS alignment or BITA is defined as "*applying IT in an appropriate and timely way, in harmony with business strategies, goals, and needs"* (Jerry N Luftman, 1999, p. 109). It can be seen as a continuous process rather than an end state, implying there is not a state one can reach, but rather a certain degree of alignment which needs continuous effort and attention (J. Peppard, K. Breu, 2003).

COISA

Co-Evolutionary or co-evolution can be defined as "evolutionary changes that occur in genetically unrelated species as they interact with each other in their environment" (J. Peppard, K. Breu, 2003, p. 745). However, in the context of Co-evolutionary, it/is alignment (COISA) it refers to the continuous process and activities of changing and adapting ways of working due to interaction between people (Benbya & McKelvey, 2006). COISA aims to grasp the mechanisms behind how alignment can be improved and is best described as "a continuous process including two-way interactions be-tween business, IT and external parties and between strategic and operational alignment processes." (Walraven et al., 2018) There are essentially two distinct models with a slightly different scope on COISA; The approach based on processes and distinct organizational levels of Benbya & McKelvey (2006) and the competencies-based approach of Walraven (2019a). The model by Benbya & McKelvey (2006) defined COISA as a continuous process on three distinct organizational levels: Strategic, Operational, and Individual.

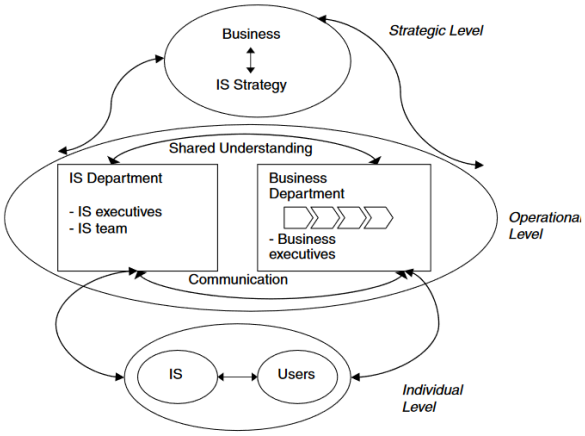

Figure 1 COISA overview by Benbya & McKelvey (2006)

The competencies based COISA model by Walraven (2019a) does not define distinct organizational levels but rather focusses on the (alignment) competencies and its enablers.

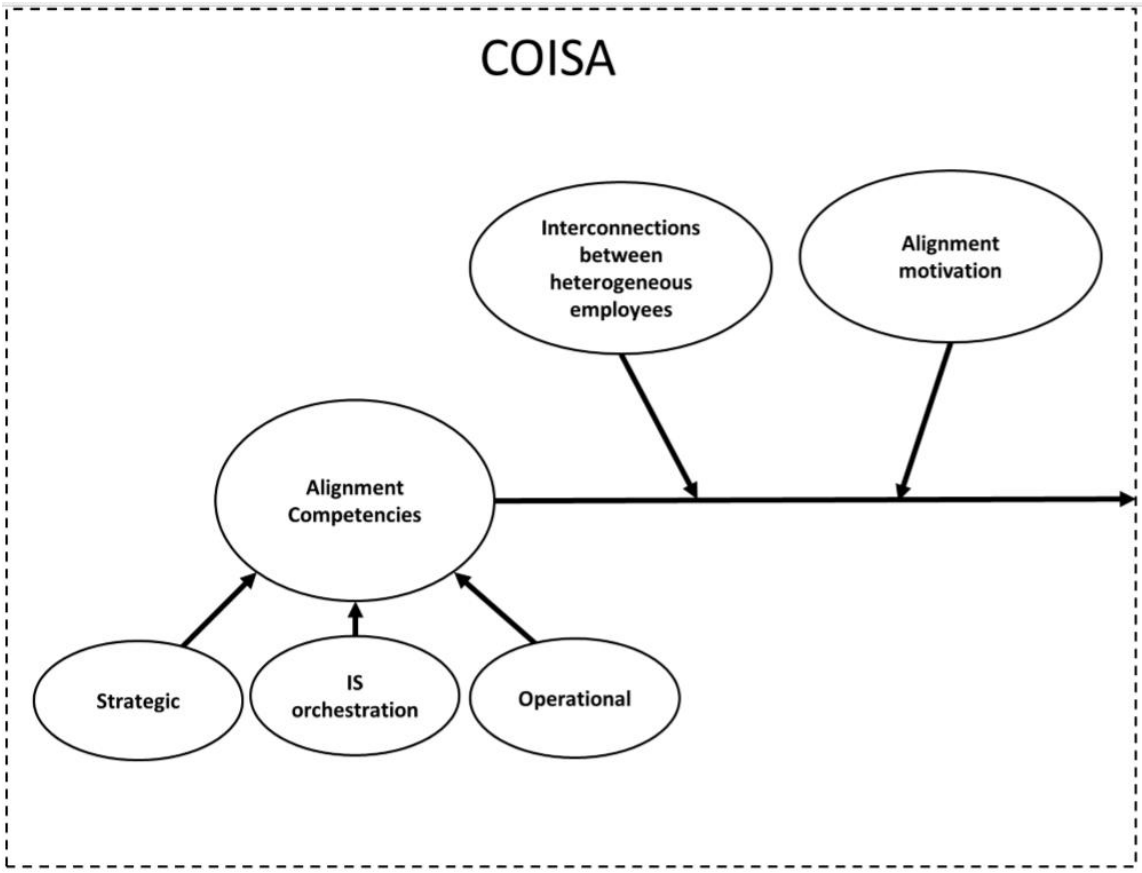

Figure 2 COISA model by Walraven (2019a)

Alignment competencies is an accumulation of three distinct categories of alignment competencies: Strategic, Orchestration, and Operational complemented with enablers' interconnections' and 'alignment motivation.' For this research, the competence-based approach is more suitable. Thus for the scope of this paper, COISA is defined according to the above model by Walraven: "*Continuously exercised operational, orchestrational and strategic alignment competencies"* (Walraven, 2019a). According to this model, COISA will, in this paper, be operationalized based on the alignment competencies: Strategic, Orchestrational, Operational, and their enablers heterogeneous interconnections and alignment motivation.

Dynamic capabilities

Dynamic capabilities embody the sum of a set of procedures and processes involving sensing, seizing, and reconfiguring (Wilden et al., 2013; Siegfried P et al., 2012). These have become increasingly more important to adapt promptly to keep up with the changing environment (Kahre et al., 2007). Moreover, it can even be deemed a necessary condition for success (Wilden et al., 2013). In this research paper, we utilize the operationalization for Dynamic Capabilities as developed by Janssen (2016). This operationalization is focused on service innovation (Janssen et al., 2016), rather than product innovation, such as the operationalization by Wilden (2013). The service-orientated approach of Janssen (2016) is more suitable for this study, as the public sector is generally more service orientated

Literature suggests that dynamic capabilities would improve once more attention would be paid to alignment (Siegfried P, Et al., 2012). Many different research papers support that conclusion. For example, the research of Schwarz et al. (2010) involving analyses of fifty-eight European companies, concluded that there is a strong relationship between alignment and dynamic capabilities. Ya-Hui Lien (2007) supports this theory by concluding that organizational alignment has a significant impact in contributing to dynamic capabilities. In a later paper of 2009, Ya-Hui Lien wrote: *"This study provides supporting evidence for the hypothesis that process alignment influences performance directly and indirectly through dynamic capabilities."* (Ya-Hui Lien, et Al., 2009, p. 3) As both process and organizational alignment are distilled from alignment competencies, it stands to reason that in light of the current knowledge, alignment competencies and COISA as a whole have a positive influence on Dynamic capabilities.

This led to the following hypothesis:

H1 *The degree of alignment competencies has a positive effect on the dynamic capabilities of an organization.*

A case-study in 2006 scored company performance along alignment and motivation and concluded that effective alignment called for motivation and active involvement of upper management (Bruggeman & Decoene, 2006). The motivation or active involvement can be defined as part of 'Alignment motivation,' which refers to the will or motivation to reduce misalignment. This can be concluded from the work of Jorfi (2011), Which also concluded that alignment motivation increased overall effectiveness (Hassan Jorfi. Et al., 2011). The work of Ya-Hui Lien (2009) further supports the findings of Jorfi (2011), Ya-Hui Lien (2009) found that alignment affected dynamic capabilities and that organizational learning and the will to learn was affecting the performance of this relation. Therefore, we establish the following hypothesis:

H2 *Alignment Motivation has a positive effect on the relationship between alignment competencies and Dynamic Capabilities*.

Furthermore, other research found that the extent to which alignment competencies result in better Dynamic Capabilities is influenced to an extent by the 'social dimension,' including the nature of collaboration. (Nigel et al., 2005) While a heterogeneous collaboration requires more effort to gain and maintain a shared understanding (Leimeister & Bittner, 2014), the heterogeneous collaboration also leads to a better change capability than homogenous collaborations (Gao et al., 2018) allowing faster changes and adaption (Winter & Zollo, 2002). There is also evidence that the innovation process, which can be defined as 'reconfigure' part of dynamic capabilities (Teece, 2007), is positively affected by Heterogeneous collaboration. (Walsh, et al., 2016) Therefore we can define the following hypothesis:

H3' *Interconnections between heterogeneous employees' has a positive effect on the relationship between alignment competencies and Dynamic Capabilities.*

Conceptual model

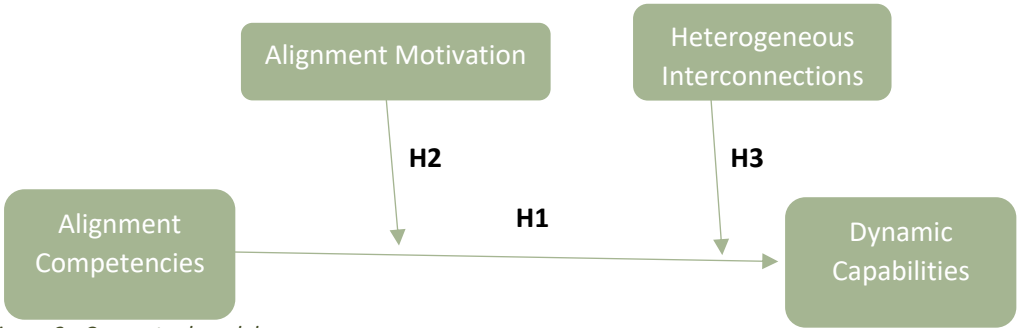

Figure 3 - Conceptual model

2.4. The objective of the follow-up research

This research aims to establish knowledge on the relationship between alignment competencies and dynamic capabilities in the public sector. More insight into this relationship would give a better understanding of why alignment might be hard to get right in practice, as well as offer new insights for further research and quantitative substantiation to the body of knowledge on COISA. The goal is to establish whether a positive relationship can be found between utilizing alignment competencies and having dynamic capabilities, as well as validating the moderators on this relationship. Establishing this requires information that indicates the level of existence for alignment competencies and dynamic capabilities, as well as the moderating factors interconnections and alignment motivation in a large number of complex organizations.

3. Methodology

In business and management research, there are five widely accepted philosophies. Namely, Positivism, Critical realism, interpretivism, postmodernism, and pragmatism. (Saunders, 2015) Each philosophy has its specific ontology, epistemology, axiology, and a typical method of research. This study can be considered as applying the positivism philosophy. The axiology of positivism, which describes the role of value, describes a neutral and independent researcher. (Saunders, 2015) This suits this study, as the researcher involved is not part of the phenomenon that is studied, unlike philosophies such as the interpretivism philosophy. The different approaches to the role of the researcher differentiate positivism from most other philosophies, although the critical realism philosophy is similar in this regard.

However, while the critical realism philosophy is similar regarding the role of the researcher, critical realism has typical methods aimed at retrodictive and in-depth historically situated analysis. This method differentiates from the positivist philosophy, which has a typical method utilizing a quantitative deductive approach. (Saunders, 2015) The latter, a quantitative and deductive approach, best suits this study. The deductive approach is suitable for various reasons, one being the limited time frame of this study, which better suits a deductive study. (Saunders, 2015) However, more importantly, the deductive setup originates apart from limited resources from the hypotheses already formed through previous literature. For the purpose of this research, however, we tested hypotheses based on findings in previous literature. Inductive research would thus not be suitable, as that would require the formation of theory from analyzing data rather than proving the determined hypotheses with analyzing data (Saunders, 2015).

This quantitative study tested the validity of hypothesis 1 to determine whether or not alignment had a positive effect on dynamic capabilities. Furthermore, we tested hypotheses 2 and 3 to establish whether or not alignment motivation and heterogeneous interconnections between employees can be considered moderators on this relationship.

In order to answer these questions, data was required from multiple complex organizations indicating their alignment competencies, their degree of dynamic capabilities, the level of alignment motivation, and the level of interconnections. This data should be available by utilizing key stakeholders in the relevant processes, which would be, for example, IT managers or Business architects.

This data was estimated to be available by utilizing key stakeholders in the relevant processes, which would be, for example, IT managers or (IT) architects. To reach these specific functions, we utilized multiple strategies. The primary strategy was to utilize social media platform LinkedIn, as this would allow targeting the respondents by their function title, as well as sorting on organizations from the public sector. LinkedIn profiles that matched on a relevant title, such as ‘Enterprise Architect’ and worked for an organization in the public sector, were sent direct messages. However, due to limitations in the number of messages a person is allowed to send through LinkedIn, other strategies were deployed as well. Public posts were made on LinkedIn as well as some specific groups. Furthermore, several sites were contacted, of which ibestuur.nl published a post linking to our questionnaire to support the response rate further. As the response was still below the desired target of 100 – 120 responses, we also deployed convenience sampling by utilizing our networks. All

four researchers individually contacted relevant persons they knew in their surroundings to generate more responses, as well as spread the survey to others. Furthermore, we resorted to contacting specific organizations in the public sector by mail or phone to establish more responses.

COISA

While there are concept models on COISA, no useful operationalization for the alignment competencies or its enabler was present at the time of writing. Thus, to ensure a validated questionnaire, the operationalization was done through the usage of Q-sort (QST) sessions with multiple researchers in the same field. The session divided the questions among the alignment competencies; Strategic, Orgestrational, and operational, as well as the moderating constructs Alignment motivation and heterogeneous interconnections. Questions that were not unanimously divided in the same category were altered or removed, which ensure that the questions are valid in the sense that they gather the intended data.

Dynamic Capabilities

Dynamic Capabilities embody the Sense, Seize & Reconfigure as described by Teece (2007).

However, for the specific questions on dynamic capabilities in the survey, this study utilized the operationalization as developed by Janssen (2016). This operationalization is focused on service innovation (Janssen et al., 2016), rather than product innovation, such as the operationalization by Wilden (2013). The service-orientated approach of Janssen (2016) is more suitable for this study, as the public sector is generally more service orientated. Questions on Dynamic Capabilities are validated as they are used directly from the article by Janssen (2016).

A survey was utilized to extract the required data in a standardized and validated way. The questions had to be answered on a Likert scale. The validity of the questions was validated through the usage of Q-sort (QST) sessions with multiple researchers. In the case of questions on Dynamic Capabilities, we used previously validated questions from the work of Janssen (2016).

Once all questionnaires were returned, data analyses were performed through modeling the results using Partial Least Squares Structural Equation Modelling (PLS-SEM). PLS-SEM is a widely accepted and utilized method proven to be effective even with small sample sizes (Wilden et al., 2013).

PLS-SEM was deemed the most suitable Structural Equation Modelling technique, as it is preferred over CB-SEM for prediction and explanation of target constructs such as in this study. (F. Hair. et al., 2017) This is true in part due to the underlying differences; PLS-SEM, for example, does not require normally distributed data unlike CB-SEM and has greater statistical power due to high parameter estimation efficiency. (F. Hair. et al. 2017) Furthermore, PLS-SEM is particularly suitable for analysis with limited sample size. (F.Hair. et al., 2017; Wilden et al., 2013) This made PLS-SEM particularly suitable; the low response rate meant the data analysis would need to be compatible with the limited amount of samples. Furthermore, as the data is not normally distributed, PLS-SEM is a suitable choice. The PSL-SEM modeling and analysis were performed using SmartPLS3, further explained in chapter 4.

The validity of the research questions was ensured through the previously mentioned QST sessions or usage of previously validated questions. Furthermore, reliability is made possible through transparency about the research method enabling reproduction of the outcome. Furthermore, we used a careful selection of respondents. The careful selection was made possible by targeting specific functions and organizations.

However, as we also resorted to public links to the questionnaire, as well as allowed respondents to pass along the link to the questionnaire, the initial careful selection would not be sufficient to guard the reliability of the sample group. We anticipated this aspect, and as such, we included questions to verify that the person filling in the questionnaire belongs to the target group. Examples are job description and verification of whether or not one works in the public sector. These extra fields allowed filtering the responses, which is particularly crucial for those who filled in the questionnaire through public links or via others.

For the desired sample size, we first determined what would have been the bare minimum for this study. By utilizing PLS-SEM, there is a rule of thumb that a tenfold of the most considerable amount of structural paths would be the minimum sample size. (F. Hair. et al., 2017) For this study, that would be 60 responses according to this rule. However, as the sample size of a questionnaire will be determined by a combination of response rate and targeted persons, it was hard to accurately predict the needed target group to reach the desired sample size. We estimated that 100 would be a safe margin over the minimum of 60. As the limited timeframe of this study also set boundaries on the expected sample size, we aimed for 25 responses per researcher, totaling 100 responses for this study. The estimation was based on an estimated effective reach of 100 persons per researcher through calling or mailing organizations and targeting roles on LinkedIn. Personal contact with potential respondents in their network should have a relatively high response rate and should add at least five net responses for a total net response of 25 per researcher (Saunders, 2015). However, it seems we overestimated the response rate on LinkedIn, resulting in 70 net responses, or 17 - 18 per researcher.

Privacy & Ethics

Respondents were not paid or compensated in any way for their participation. In order to avoid any privacy issues, the questionnaire kept questions that could be traced to a specific person to a minimum. Furthermore, to guard the sensitive data, the questionnaire was only available to be filled in through hosting on Open University servers where data only left those specified European servers in anonymized form. Sensitive data such as job description was only used to determine the validity and reliability and is treated as confidential and thus not used or distributed in any way. Moreover, the data gathered with this survey is only used for research purposes and not provided to third parties.

4. Results

In this chapter, we will outline the results of this study. First, we will go into the specific filtering on response data. Then a part will describe the results on validity and reliability of constructs. We then continue with the analysis of the structural model, which will give insight into the significance and effect values of relationships between the studied variables.

4.1. Filtering response data

The survey was pre-coded in Limesurvey, and this meant we could save time and export only the answer codings. Answer codings are generally more suitable for analysis than full-text answers.

While Limesurvey supports basic filtering, such as only exporting survey data from 100% completed surveys, these functions seemed to lack granular control. Therefore we decided to filter manually in Excel for better insight and control of the filtering process. Particularly valuable as a few constructs in the survey are unused for this study, which increases odds that partial data might still be useful.

The raw export, without any filtering, contained 181 records of respondents. According to literature, results that exceed 15% of blank fields should be removed. (F. Hair. et al., 2017) In practice, this meant any record containing blanks in one or more columns of the required constructs were removed as this would exceed 15%. The filtering invalidated 105 records, leaving 76 records in place. Almost all removals were wholly blank, and thus, in this filtering stage, no valuable data was lost.

Furthermore, five Initial test responses were removed, resulting in a list of 71 records. These were manually checked for their suitability based on their job description and organization. For the scope of this study, we were aiming for organizations in the (semi)public sector, including a secondment in this sector. Five results stood out due to their employer not being public-sector or semi-public. Four of these, however, turned out to work for companies in healthcare, transport, or related to education and were kept in due to being closely related to the public sector. One was filtered out due working at a fortune 500 packaging company rather than public domain, bringing the record count to 70

One did not specify the nature of his work but stated to be an architect with 50+ years of experience. The decision was made not to exclude this record and favor more records over strict filtering on the public sector. The fact that the response rate was low, resulting in a limited amount of suitable records, played a role in this decision.

The last check before utilizing the dataset for statistical analyses was a check for suspicious answering. In particular, the phenomenon' straight-lining.' (F. Hair. et al., 2017) With straight-lining all, or almost all answers on a record are the same, which should usually be removed. However, the record with the most identical answers still differentiated 8 out of 34 constructs, and thus was kept in place.

4.2. Final sample size

Seventy records are on the low side, but it does meet the minimum criteria, which is stated to be a tenfold of the most considerable amount of structural paths. (F. Hair. et al., 2017) A tenfold of the most considerable amount of structural paths would for this study result in 60. The minimum of 60 is thus exceeded by over 16% with a total of 70. The sample size remains low, however, at just 16% above bare-minimum. The relatively low sample size means that the risk of Type II errors increases, and firm conclusions should await a study with more samples. Appendix 1 shows the data used in this paper.

4.3. Construct reliability & validity

The data file was imported as CSV format in SmartPLS version 3.2. The model below was created as an initial model to represent this study.

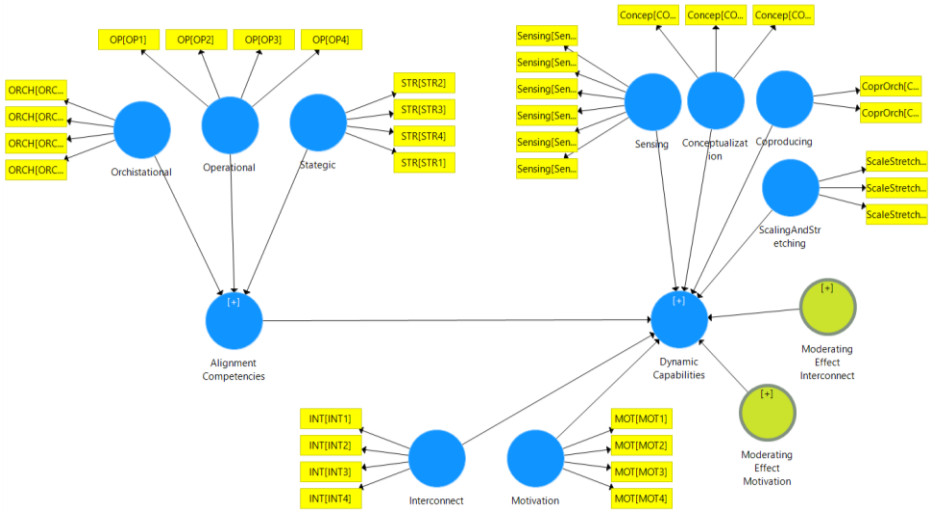

Figure 4 - SmartPLS Constructs overview

Alignment Competencies, Interconnect, and Motivation, are linked as an exogenous latent variable, explaining the endogenous latent variable 'Dynamic Capabilities.' Interconnect and motivation are defined as a moderating effect on the relation between 'Alignment Competencies' and 'Dynamic Capabilities.'

This model will suffice for validating construct reliability, as well as creating latent variable values for the second-order constructs. After these assessments, the constructs of Dynamic Capabilities will be replaced by the latent value for Dynamic Capabilities, to allow assessing the evaluation of the structural model.

In order to ensure the validity of this research, specific indicators are assessed to determine Convergent and discriminant validity, as well as internal consistency. See below a summary of these assessments. Numbers in Bold indicate the typical criteria were not met, and values in brackets indicate values after items were removed. Elaboration on each topic is discussed below the table in more detail.

Table 1 - Summary table assessment reflective model (F. Hair. et al., 2017)

Latent variable	**Indicator**	**Convergent**			**Internal Consistency Reliability**		**Discriminant**
		Loadings	Indicator Reliability	AVE	Composite reliability	Cronbach's Alpha	HTMT
		>.7	**>.5**	**>.5**	**.60 - .95**	**.60 - .95**	**NOT 1?**
Concep	Concep1	0,896	0,803	0,754	0,902	0,837	Yes
	Concep2	0,873	0,762				
	Concep3	0,836	0,699				
CopOrch	CoprOrch1	0,902	0,814	0,839	0,912	0,809	Yes
	CoprOrch2	0,93	0,865				
ScaleStretch	ScaleStretch1	0,905	0,819	0,825	0,934	0,894	Yes
	ScaleStretch2	0,885	0,783				
	ScaleStretch3	0,935	0,874				
Sensing	Sensing1	0,753	0,567	0,566	0,886	0,845	Yes
	Sensing2	**0,66**	**0,436**				
	Sensing3	**0,659**	**0,434**				
	Sensing4	0,757	0,573				
	Sensing5	0,858	0,736				
	Sensing6	0,806	0,650				
OP	OP1	0,842	0,709	0,682	0,895	0,844	Yes
	OP2	0,798	0,637				
	OP3	0,847	0,717				
	OP4	0,815	0,664				
Orch	ORCH1	0,873	0,762	0,816	0,947	0,924	Yes
	ORCH2	0,861	0,741				
	ORCH3	0,932	0,869				
	ORCH4	0,944	0,891				
Str	STR1	0,891	0,794	0,771	0,931	0,901	Yes
	STR2	0,865	0,748				
	STR3	0,882	0,778				
	STR4	0,874	0,764				
Int	INT1	0,898	0,806	0,743	0,92	0,884	Yes
	INT2	0,866	0,750				
	INT3	0,877	0,769				
	INT4	0,803	0,645				
Mot	MOT1	0,894	0,799	0,844(.851)	**0,956**(0,945)	0,938(913)	Yes
	MOT2	0,944	0,891				
	(MOT3)	0,93	0,865				
	MOT4	0,906	0,821				

4.3.1. Internal consistency

First, we assess the internal consistency of the reflective constructs. This analysis uses the traditional Cronbach's Alpha, but as Cronbach's Alpha assumes equal reliability for indicators, we assess the Composite reliability values as well. Full tables are accessible in appendix 3.

Cronbach' Alpha

$$Cronbach's\,\alpha = \left(\frac{M}{M-1}\right) \cdot \left(1 - \frac{\sum_{i=1}^{M} {s_i}^2}{{s_t}^2}\right).$$

Figure 5 Cronbach's A (F. Hair. et al., 2017)

To assess the internal consistency, we first assess the Cronbach's alpha values. Values should be between .7 and .95 to indicate sufficient internal consistency. (F. Hair. et al., 2017) Cronbach's alpha returns values in the range of .809 to .938, which all fall well within the set margins and thus is considered a good indication of reliability.

Composite reliability

$$\rho_c = \frac{\left(\sum_{i=1}^{M} l_i\right)^2}{\left(\sum_{i=1}^{M} l_i\right)^2 = \sum_{i=1}^{M} var\,(e_i)},$$

Figure 6 - Formula Composite Reliability (F. Hair. et al., 2017)

To further support the results of Cronbach's Alpha, we examine the composite reliability values, which should ideally be between .6 and .9 and stay below .95. (F. Hair. et al., 2017) We can see that values appear on the high side, with the 'alignment motivation' construct resulting in a value of .956, just above the .95 'threshold' value. The high values indicate that indicators of this construct are overlapping more than desired in the measured phenomenon. We thus evaluated if removing an indicator would improve the Composite reliability score, without falling below the lower threshold of either composite reliability or Cronbach's Alpha. Removing indicator MOT3 resulted in composite reliability values of .945 for alignment motivation while maintaining a Cronbach's Alpha value above .9 with .913.

Internal consistency results

Cronbach's alpha is known to be conservative and underestimate reliability slightly. At the same time, the opposite is true for composite reliability, which means that the actual reliability usually lies somewhere in between both values. If we then look at ranges after removing MOT3, we see values from 0.809 - .924 for Cronbach's Alpha and values ranging from .886 - .947 for Composite reliability. While on the high side, it falls within reasonable limits. (F. Hair. et al., 2017)

4.3.2. Convergent validity

Convergent validity was measured by utilization of Average Variance Extracted (AVE) as well as Examination of Outer loadings. These assessments should give insight into the extent to which measures correlates positively with alternative measures within a construct. (F. Hair. et al., 2017)

Average variance extracted (AVE)

$$AVE = \left(\sum_{i-1}^{M} l_i^2 \right) .$$

Figure 7 - Formula AVE (F. Hair. et al., 2017)

Values for Average Variance Extracted (AVE) should typically be above .5 to indicate that there are no issues on convergent validity. (F. Hair. et al., 2017) On analyzing the AVE values, we found that their values ranged from .566 to .851. As all values were above the .5, this indicates no issues were found on convergent validity. See for the full table with values appendix 3.

Outer loadings

As we utilize a reflective model, we assess the Outer loading values rather than outer weights as with formative relations. (F. Hair. et al., 2017) Outer loading, also referred to as the indicator reliability, should typically be a value above .7 to ensure the latent variable can explain at least 50% of each indicator's variance. (F. Hair. et al., 2017) If values fall below the desired threshold value of .7 but score values above .4, they are only removed if this positively influences composite reliability. However, if values are below .4, they should always be removed. (F. Hair. et al., 2017)

We assessed the outer loading values, and this shows a spread between values of .659 and values of .944. Thus not all values meet the desired threshold value of .7 as two indicators from the sensing construct score below the threshold. Indicator sensing 2 scored .66 and indicator sensing 3 scored .659.

However, as written earlier, the theory suggests that values below .7 should be kept if they are above .4 and removing does not positively influence composite reliability. Since removing either or both does not positively influence composite reliability and their scores are well above .4, the indicators are not removed.

Convergent validity results

As analyzed above, both AVE analysis and examination of Outer loadings show no concerns regarding convergent validity.

4.3.3. Discriminant validity

Discriminant validity will be judged based on Cross-loadings, and Hetrotrait-monotrait (HTMT) ratio for the first constructs. Fornell Larcker criterion is not utilized as it was deemed inferior to the HTMT method for this study. (F. Hair. et al., 2017) To assess the formative relationship between the first and second-order constructs, we analyzed the significance of outer weights. See below for per item description of the results. Full tables are available in appendix 3.

Cross-loadings

Cross-loading analyses show that all indicators load on their respective construct and that this loading exceeds the cross-loadings on other constructs. See Appendix 3 for the full table of the cross-loading values.

The observation that all indicators primarily load on their respective construct indicates that discriminant validity is present for all indicators used in this study.

Heterotrait-Monotrait ratio (HTMT)

The HTMT score is examined to establish insight on the validity were cross-loading methods provide little information: The cases were constructs show high similarity. HTMT values should ideally stay below .9 (F. Hair. et al., 2017). As seen in the table below, values stay well below .9 with only four values above .8. The fact that these HTMT values fall below their thresholds further supports discriminant validity.

HTMT	Concep	CoprOrch	INT	MOT	OP	ORCH	ScaleStretch	Sensing	STR
Concept									
Coproducing	0,734								
Interconnect	0,712	0,768							
Motivation	0,664	0,581	0,762						
Operational	0,637	0,641	0,715	0,561					
Orchistational	0,650	0,685	0,719	0,581	0,576				
ScaleStretch	0,642	0,583	0,53	0,268	0,507	0,423			
Sensing	0,831	0,74	0,8	0,562	0,78	0,739	0,747		
Stategic	0,731	0,807	0,85	0,585	0,746	0,744	0,595	0,856	

Figure 8 – Heterotrait-Monotrait Ratio (HTMT) Values

Significance of outer weights

The formative relation between first and second-order constructs is analyzed by their significance of outer weights and outer loading values. To accomplish analysis results for these values, the model in SmartPLS was adjusted, replacing the first-order constructs with indicators containing their latent value, as shown below.

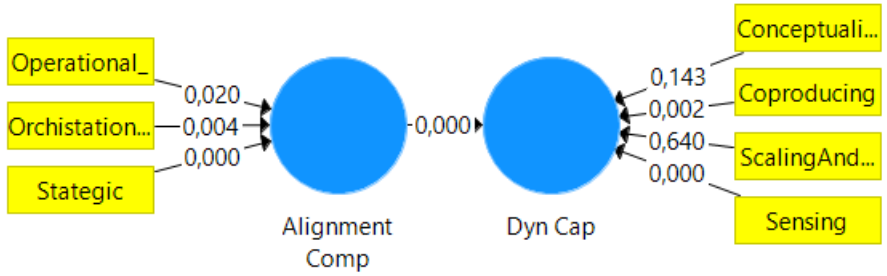

Table 2 – P-values Outer Weights (formative relations)

As seen in figure 2 above, the P-values of ScalingAndStretching (.640) and Conceptualization (.143) are above .05 and therefore not significant. (F. Hair. et al., 2017) In order to decide whether or not to remove these items, the work of Hair (2007) suggests assessing their outer loading values. If their outer loading values are above .5, it is suggested to keep the items regardless of their insignificant P-values. (F. Hair. et al., 2017) See below for a table of their outer loading values.

Formative relation	Outer loading
Conceptualization -> Dyn Cap	0,803
Coproducing -> Dyn Cap	0,842
Operational_ -> Alignment Comp	0,796
Orchistational -> Alignment Comp	0,832
ScalingAndStretching -> Dyn Cap	0,631
Sensing -> Dyn Cap	0,945
Stategic -> Alignment Comp	0,943

Table 3 Outerloading values formative relations

As seen in the table above, all outer loading values are above .5, and thus removal of formative indicators ScalindAndStretching or Conceptualization is not recommended. (F. Hair. et al., 2017)

4.4. Evaluation of structural model

In this part, we evaluate the structural model. We start by checking collinearity, as collinearity issues could trouble further analysis. We then proceed with analyzing the size and significance of path coefficients, F2 effect sizes, predictive relevance, and finally, q2 effect size.

4.4.1. Assessment of collinearity

To establish potential collinearity issues, we verified that the Inner VIF values do not exceed their threshold of 5. (F. Hair. et al., 2017) SmartPLS returned a maximum inner VIF of 3.697 for interconnections on Dynamic Capabilities, and most others were well below 3. The fact that these values fall below their desired threshold indicates no immediate collinearity concerns. Appendix 3 shows the full table of Inner VIF values.

4.4.2. Size and significance of path coefficients

The significance of the path coefficients is evaluated based on their P-value. We assume a significance level at 5%, meaning that P values should be below 0.05 to be concluded significantly. (F. Hair. et al., 2017)

Significance of total effect	**Total effect**	**T value**	**P-Value**	**Significant**
Alignment Competencies -> Dynamic Capabilities_	0,653	5,277	0	Yes
Interconnect -> Dynamic Capabilities_	0,201	1,405	0,16	No
Moderating Effect Interconnect -> Dynamic Capabilities_	-0,041	0,443	0,658	No
Moderating Effect Motivation -> Dynamic Capabilities_	-0,03	0,265	0,791	No
Motivation -> Dynamic Capabilities_	-0,003	0,025	0,98	No

As seen in the table above, only the relationship between 'Alignment competencies' and Dynamic Capabilities' is considered statistically Significant. The significance of the relationship between 'Alignment competencies' and 'Dynamic Capabilities' reflects Hypotheses H1 of this study, which predicted this relationship. Other relationships have P values considerably above 0.05. They are thus not deemed statistically significant, which indicates no statistical significance for both Hypothesis H2 and H3. This means that while we found evidence for Hypotheses H1, no evidence was found for the moderating variables in this study.

Coefficient of determination (r2)

$$R^2_{adj} = 1 - (1 - R^2) \cdot \frac{n-1}{n-k-1},$$

Figure 9 - Formula R2 adjusted (F. Hair. et al., 2017)

The R2 coefficient of determination has no static threshold value. However, for scholarly research such as this paper, it is common to judge .25 as weak, .50 as moderate, and .75 as substantial. (F. Hair. et al., 2017) Higher values indicate that the predictions would be of higher accuracy.

The R2 coefficient of determination of the endogenous construct, Dynamic Capabilities, is calculated by SmartPLS and returned a value of .682. The R2 adjusted resulted in a value of .658. These values indicate a moderate-substantial coefficient of determination.

F2 effect sizes

To evaluate if constructs have a substantial effect on the endogenous construct 'Dynamic Capabilities,' we further utilize F2 square effect values. F2 values of less than .02 indicate no effect. 0.02 is considered a small effect, .15 a medium effect, and .35 and higher is considered a large effect. (F. Hair. et al., 2017)

F2 effect sizes	**Dynamic Cap**	**Effect**
Alignment Competencies	0,466	Large
Interconnect	0,035	Small
Moderating Effect Interconnect	0,003	None
Moderating Effect Motivation	0,001	None
Motivation	0	None

Figure 10 - F2 square Effect sizes

In the table of figure 9 above, we can see the different F2 effect values, along with their size rating. We can see that the effect of 'Alignment Competencies' on 'Dynamic Capabilities' is considered large. 'Interconnections' seems to deliver a small effect but was deemed not significant due to its relatively high P-value in 'size and significance of path coefficients.'

4.4.3. Predictive relevance (Q2)

SmartPLS is used to calculate values for the Stone-Geiser Q2 value, by using Blindfolding with omission distance set to 8. Values should be above zero to support the predictive relevance of the model. (F. Hair. et al., 2017)

Construct cross-validated redundancy shows estimates for Q2 of .583 for the latent variable' dynamic capabilities' This value is considerably above zero and thus provides support for the model's predictive relevance on the endogenous, or dependent, variable 'Dynamic Capabilities.'

4.4.4. q2 effect size

$$q^2 = \frac{Q^2_{included} - Q^2_{excluded}}{1 - Q^2_{included}}.$$

Figure 11 - Formula q2 Effect size (F. Hair. et al., 2017)

The q2 effect size is a *'measure to establish how well the path model can predict the originally observed values.'* (F. Hair. et al., 2017, p. 23/50)

All previous data analyses were performed in SmartPLS 3; however, SmartPLS does not support the calculation of the q2 effect size, which thus was calculated manually. The q2 effect size can be calculated utilizing the Q2 included, and Q2 excluded, as seen in the formula in figure 10 above. Q2 included is calculated by SmartPLS and also previously used in the predictive relevance, where it returned a value of .583. See appendix 2 for the full tables.

The Q2 excluded is calculated by removing the construct' alignment competencies' from the model in SmartPLS and then performing a new blindfold calculation. The blindfold calculation without the construct' alignment competencies' gives a new Q2 value for 'Dynamic Capabilities' of .515 and is considered the Q2 excluded value. Now we have both the Q2 included and the Q2 excluded values and thus can perform the formula of figure 10 to establish the q2 effect size.

To calculate the Q2 effect size of 'Alignment competencies' on 'Dynamic Capabilities', we divide (q2included – q2excluded) over (1 – q2 included). This results in (0.583 - 0.509) / (1 -0.583) = 0.177

The Q2 effect value of 0.177 indicates a medium (F. Hair. et al., 2017) predictive relevance for the endogenous construct 'Dynamic Capabilities.' The classification is generally 'small,' 'medium,' 'large' were values 0.02 – 0.15 are considered 'low,' 0.15 – 0.35 are considered 'medium,' and values above 0.35 are considered 'large.' (F. Hair. et al., 2017)

5. Discussion, conclusions, and recommendations

This part sets out with a critical reflection, stating short-comings or weaknesses of this study. The reflection is followed by a section discussing and concluding the results of this study. After the final conclusion, we have two sections describing the recommendations for practice and describe how further research might fill in the short-comings of this study and extend the body of knowledge on this subject further.

5.1. Discussion – reflection

The response rate was lower than expected. This resulted in 71 results after filtering out incomplete responses and removing test values. Checking for a match between job description and public sector furthermore ruled out one response, as its private sector context made it invalid. Thus this paper is based on 70 responses. Which, while meets the minimum criteria for this model as set by Hair (2017), means that firm conclusions might require further research. The fact that the response count is on the low side also had an influence on how strict further filtering progressed. For example, responses were kept in from consultancy agencies which, while often work in-, are not part of the formal public sector. If the response rate was higher, one could have made a strict filter on public sector organizations, which would have better suited the research question. Furthermore, we had to delete one of the four indicators for motivation, namely MOT3, due to an otherwise problematic high composite reliability. This indicates that the indicators of motivation are potentially overlapping. On the outer weights significance testing, we saw two indicators, ScalingAndStretching and Conceptualization, both from the Dynamic Capabilities construct, which scored insignificantly. This might indicate that the operationalization of Dynamic Capabilities was suboptimal as two out of four indicators were found insignificant and thus not seem to explain the phenomenon Dynamic Capabilities. Furthermore, there are some limitations to the utilized methodology, as well as the way it was used in practice. This paper is survey-based and of quantitative matter in a specific sector, namely the public sector. Results are, therefore, not necessarily applicable in other sectors. Furthermore, as a result of targeting primarily Dutch respondents, the vast majority of the respondents appear to be from the Netherlands, and as such, results may vary in other countries or cultures. Further research could clarify whether the results of this study are applicable to other sectors and cultures. A qualitative study might, on the other hand, give a more in-depth insight into what mechanisms are at play when it comes to dynamic capabilities. Such a study might find more about why we could not establish moderating variables to be significant.

5.2. Conclusions

The purpose of this paper was to establish more knowledge on the potential influence of COISA on dynamic capabilities at large organizations. To gather this insight, we aimed to answer the central research question: *What is the impact of co-evolutionary IS alignment on the dynamic capability of complex organizations in the public sector?*

To answer this research question, we set out three hypotheses and tested their validity. The hypotheses we formed were:

1. **H1** *The degree of alignment competencies has a positive effect on the dynamic capabilities of an organization.*
2. **H2** *Alignment Motivation has a positive effect on the relationship between alignment competencies and Dynamic Capabilities*.
3. **H3'** *Interconnections between heterogeneous employees' has a positive effect on the relationship between alignment competencies and Dynamic Capabilities*

We found that COISA does indeed have an impact on dynamic capabilities through a positive relationship between alignment competencies and dynamic capabilities. We must note, however, that this found relationship is between a part of COISA and Dynamic Capabilities. COISA embodies not only alignment competencies but includes the moderating effects of Alignment motivation and heterogenous interconnections. These moderating effects are recognized in this study through hypotheses H2 and H3. Unlike H1, however, Hypotheses H2 and H3 were not found statistically significant.

To further answer the research question more thoroughly, we discuss each hypothesis individually below and elaborate on how our findings relate to each hypothesis and the literature behind that hypothesis.

H1 *Does the degree of alignment competencies have a positive effect on the dynamic capabilities?*

The results in this study show that alignment competencies indeed do have a positive effect on dynamic capabilities. The found effect matches similar findings from other studies. (Siegfried et al., 2012; Ya-Hui Lien et al., 2007,2009, Swcharz et al., 2010)

Other studies, such as the work of Swcharz et al. (2010) also found supportive evidence for the relationship between alignment competencies and dynamic capabilities. Swcharz (2010) also used the PLS-SEM method but used randomly selected companies across Europe. It supports the findings of this paper in concluding that Aligning IT & business increases both operational and strategic performance. (Schwarz, Et al., 2010) This might indicate that the findings of this paper are reproducible outside the public sector, as Schwarz found. It did, however, not refer to dynamic capabilities in specific, but instead analyzed the effects on operational and strategic performance. Other studies which do utilize an operationalization of dynamic capabilities, however, found the same similarity.

For example, Ya-Hui Lien (2009) studied the impact dynamic capabilities had on company performance and included the relation between (process)alignment and dynamic capabilities in that study. (Ya-Hui Lien, et Al., 2009) Ya-Hui Lien found supporting evidence for the hypotheses that process alignment has a positive effect on dynamic capabilities and company performance. He concluded that "process alignment influences performance directly and indirectly through dynamic capabilities*."* (Ya-Hui Lien, et Al., 2009, p. 3) While the focus in the paper by Ya-Hui Lien (2009) is on process alignment rather than alignment competencies in general and not on the public sector but in a specific tech sector, the results show similarity. This can indicate that the relation Ya-Hui Lien (2009) found is not specific for the tech-sector, as we found this relationship to be positive in the public sector as well, and Schwarz (2010) found a similar relation in the private sector.

H2 *Does alignment Motivation have a positive effect on the relationship between alignment competencies and Dynamic Capabilities?*

The hypothesis that Alignment Motivation positively affects the relationship between alignment competencies and Dynamic Capabilities was not supported in this study.

The moderating relationship was not found statistically significant and, as such, showed no substantial effect. This outcome is contrary to the expectations based on literature. For example, case-study based research found that effective alignment required (alignment) motivation. (Bruggeman & Decoene, 2006) Alternatively, the work of Jorfi (2011), which concluded that (alignment) motivation increased overall effectiveness. (Hassan Jorfi. Et al., 2011) Finally, it was also Ya-Hui Lien (2009) who indicated that alignment affected dynamic capabilities and that organizational learning and the will to learn was affecting the performance of this relation. (Ya-Hui Lien, et Al., 2009) The reason we did not establish similar results can have multiple explanations. It can be the sector differences of the sample group, but more differentiating might be the operationalization of alignment motivation or the studied relationship. The work of Ya-Hui Lien (2009) does, for example, not refer to alignment motivation but rather to the will to learn, which might indicate a form of alignment motivation, but is a somewhat different approach and operationalization. Hassan Jorfi (2011) concluded that motivation had a positive effect on effectiveness but has more focus on communication effectiveness rather than dynamic capabilities. (Hassan Jorfi. Et al., 2011) It should thus be noted that one cannot simply conclude that the results of this paper contradict the results of others, as (minor) differences in approach, sample selection, or operationalization might explain the different outcomes.

H3 *Does' Interconnections between heterogeneous employees' have a positive effect on the relationship between alignment competencies and Dynamic Capabilities?*

The moderating effect of 'interconnections between heterogeneous employees' on the relationship between alignment competencies and dynamic Capabilities was also not found statistically significant in this paper. This is not expected based on literature, as research found that the extent to which alignment competencies result in better Dynamic Capabilities is influenced by the 'social dimension,' including the nature of collaboration. (Nigel et al., 2005) Moreover, work by Gao et al. (2018), found that a heterogeneous collaboration leads to a better change capability than homogenous collaborations. (Gao et al., 2018) This should allow faster changes and adaption (Winter & Zollo, 2002) and can be seen as part of dynamic capabilities.

There is also literature that suggests that the innovation process, which can be defined as 'reconfigure' part of dynamic capabilities (Teece, 2007), is positively affected by Heterogeneous collaboration. (Walsh, et al., 2016). The reason our results did not match the expectations set by literature can be hard to identify. The work of Walsh (2016) might, for example, differentiate because it only focusses on a specific part of dynamic capabilities, namely the innovation/reconfigure part. Thus the operationalization is mainly different.

Furthermore, these studies conclude a relationship between heterogeneous interconnections and dynamic capabilities, but not in a moderating setting. Hard conclusions should not be drawn based on the mixed results. There are too many differentiating factors that might (partially) explain the difference, which requires further research to clarify.

5.3. Recommendations for practice

Organizations find themselves in a growing degree, dependent on their IT, and often struggle to utilize their IT potential. (E. Gerow et al., 2014) This trend is often explained as a lack of alignment (Wilkinson et al., 2006) or dynamic capabilities. (Wilden, 2013) Numerous studies suggest focusing on dynamic capabilities (Siegfried P, Et al., 2012; Wilkinson et al., 2006; G. Winter, 2003)

However, how to create and maintain dynamic capabilities successfully remains somewhat unclear, and dynamic capabilities alone are thought to be 'not enough' (Wilden, 2013). Wilden (2013, p86), for example, concluded: "*the possession of dynamic capabilities is a necessary, but insufficient, condition to achieve superior performance."* Other research also points to other factors to gain this so-called dynamic capability. (Ya-Hui Lien et al., 2007, 2009; Schwarz, Et al., 2010) This might indicate that alignment is the missing link to leverage dynamic capabilities in a successful manner. This study proves that alignment competencies indeed have a positive influence on dynamic capabilities and, as such, can be used to leverage a more agile organization. It is, therefore, recommendable to focus on alignment competencies when trying to leverage dynamic capabilities. However, one should note the limitations of this study and note that this is not necessarily applicable to all sorts of organizations or sectors.

5.4. Recommendations for further research

This paper was able to verify and further support evidence on the relationship between alignment competencies and dynamic capabilities. However, contrary to the expectations, Hypothesis H2, 'Alignment motivation has a positive effect on the relationship between alignment competencies and Dynamic capabilities' and hypothesis H3, 'interconnections between heterogenous employees' has a positive effect on the relationship between alignment competencies and dynamic capabilities' were not supported with this paper, as neither effect was found to be statistically significant.

Further research might clarify how these results hold up to the literature from which these hypotheses were formed. It is, however, recommended for future research to reconsider

the operationalization of Dynamic Capabilities, as two out of four indicators, were deemed statistically insignificant in this study. This insignificance of indicators might be a sign of a weak spot of this study and hence be suitable for verification in further research. Furthermore, a different operationalization of Dynamic Capabilities could give insight into whether or not the operationalization in this study played a role in the moderating effects which tested insignificant. For example, one could study the effective relationship between alignment motivation and dynamic capabilities in a broader operationalization, In similarity to the work of Ya-Hui lien (2009). Alternatively, additional research could establish whether the influence of 'interconnections between heterogeneous employees' might be limited to a part of dynamic capabilities, such as the reconfigure stage found by Walsh (2016). Such a study could shed more light on how the relationship between alignment competencies and dynamic capabilities can be influenced, and thus how to maximize the leverage of dynamic capabilities.

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7. Appendix 1 Response Data

STR[STR1]	STR[STR2]	STR[STR3]	STR[STR4]	ORCH[ORCH1]	ORCH[ORCH2]	ORCH[ORCH3]	ORCH[ORCH4]	OP[OP1]	OP[OP2]	OP[OP3]	OP[OP4]	INT[INT1]	INT[INT2]	INT[INT3]	INT[INT4]	MOT[MOT1]	MOT[MOT2]	MOT[MOT3]	MOT[MOT4]	Sensing[Sensing1]	Sensing[Sensing2]	Sensing[Sensing3]	Sensing[Sensing4]	Sensing[Sensing5]	Sensing[Sensing6]	Concep[CONCEP1]	Concep[CONCEP2]	Concep[CONCEP3]	CorOrch[CorOrch1]	CorOrch[CorOrch2]	ScaleStretch[ScaleStretch1]	ScaleStretch[ScaleStretch2]	ScaleStretch[ScaleStretch3]
3	4	4	4	6	4	6	6	3	2	3	2	5	5	6	5	5	5	3	3	5	4	5	5	5	5	3	3	3	5	3	5	3	3
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5	6	5	6	5	7	6	6	6	5	5	4	6	5	5	5	6	6	6	7	6	5	7	7	6	5	6	6	6	5	5	6	6	6
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8. Appendix 2 How source origin

Found by	Author	Year	Title
EBSCO key words	Amarilli et al.	2017	An Explanatory Study on the Co-evolutionary Mechanisms of Business IT Alignment.
EBSCO key words	Benbya & McKelvey.	2006	Using coevolutionary and complexity theories to improve IS alignment: a multi-level approach.
EBSCO key words	Bruggeman & Decoene.	2006	Strategic alignment and middle-level managers' motivation in a balanced scorecard setting.
Snowballing	Brynjolfsson & Hitt.	2000	Beyond computation: Information technology, organizational transformation and business performance.
Snowballing	E. Gerow et al.	2014	RESEARCH NOTELOOKING TOWARD THE FUTURE OF IT–BUSINESSSTRATEGIC ALIGNMENT THROUGH THE PAST:AMETA
Google Scholar	F. Hair. et al.	2017	A primer on partial least squares structural equation modelling.
EBSCO key words	G. Winter.	2003	Understanding dynamic capabilities.
EBSCO key words	Gao et al.	2018	Heterogeneous Effects of Business Collaboration on Innovation in Small Enterprises: China Compared to Brazil, Indone
EBSCO key words	Hassan Jorfi. Et al.	2011	Relationships among Strategic Management, Strategic Behaviours, Emotional Intelligence, IT-business Strategic Alignm
EBSCO key words	J. Peppard, K. Breu.	2003	Beyond Alignment: A Coevolutionary View of the Information Systems Strategy Process.
Snowballing	Janssen et al.	2016	Dynamic capabilities for service innovation: conceptualization and measurement.
Snowballing	Jerry N Luftman.	1999	Achieving and Sustaining Business-IT Alignment.
Google Scholar	Kahre et al.	2007	Beyond Business-IT Alignment - Digital Business Strategies as a Paradigmatic Shift: A Review and Research Agenda.
EBSCO key words	Leimeister & Bittner.	2014	Creating Shared Understanding in Heterogeneous Work Groups: Why It Matters and How to Achieve It.
Snowballing	Merali et al.	2012	information systems strategy: Past, present, future?
EBSCO key words	Nigel et al.	2005	THE SOCIAL DIMENSION OF BUSINESS AND IS/IT ALIGNMENT: CASE STUDIES OF SIX PUBLIC-SECTOR ORGANISATIONS.
EBSCO key words	Onix et al.	2017	Complex adaptive systems theory in information systems research: A systematic literature review.
EBSCO key words	S. Van der Elst et al.	2014	Alignment processes in public organizations: An interpretive approach.
Google Scholar	Saunders, M.	2015	Research methods for business students.
Snowballing	Schwarz, Et al.	2010	A Dynamic Capabilities Approach to Understanding the Impact of IT-Enabled Businesses Processes and IT-Business Alig Firm.
Snowballing	Siegfried P, Et al.	2012	Dynamic Capabilities and Performance: Strategy, Structure and Environment.
Google Scholar	Teece.	2007	Explicating Dynamic Capabilities: The Nature and Micro foundations of
Google Scholar	Walraven et al.	2018	Co-evolutionary IS-Alignment: A Complex Adaptive Systems Perspective.
Google Scholar	Walraven et al.	2019b	USING A CO-EVOLUTIONARY IS-ALIGNMENT APPROACH TO UNDERSTAND EMR IMPLEMENTATIONS.
Other	Walraven, P.	2019a	Electronic lecture on COISA. NL.
Snowballing	Walsh, et al.	2016	Openness and innovation in the US: Collaboration form, idea generation and implementation.
Google Scholar	Wilden et al.	2013	Dynamic capabilities and performance : strategy, structure and environment.

Google Scholar	Wilden, R. G.	2013	Dynamic capabilities and performance: strategy, structure and environment. pp. 72-96.
Snowballing	Wilkinson et al.	2006	Designing an 'adaptive' enterprise architecture.
EBSCO key words	Winter & Zollo.	2002	Deliberate Learning and the Evolution of Dynamic Capabilities.
Snowballing	Ya-Hui Lien.	2007	Organizational Process Alignment and Dynamic Capabilities in High-Tech Industry.
EBSCO key words	Ya-Hui Lien, et Al.	2009	Dynamic capability: Impact of process alignment and organizational learning culture on performance.

9. Appendix 3 – Analyzing results in SmartPLS 3

9.1. Construct reliability

	Cronbach	rho_A	Composite Reliability	AVE
Conceptualization	0,837	0,844	0,902	0,754
Coproducing	0,809	0,825	0,912	0,839
Interconnect	0,884	0,891	0,92	0,743
Motivation	0,938	0,944	0,956	0,844
Operational_	0,844	0,844	0,895	0,682
Orchistational	0,924	0,926	0,947	0,816
ScalingAndStretching	0,894	0,896	0,934	0,825
Sensing	0,845	0,858	0,886	0,566
Stategic	0,901	0,901	0,931	0,771

9.2. Outer loadings

Outer Loadings	Conceptualization	Coproducing	Interconnect	Motivation	Operational_	Orchistational	ScalingAndStretching	Sensing	Stategic
Concep[CONCEP1]	0,896								
Concep[CONCEP2]	0,873								
Concep[CONCEP3]	0,836								
CoprOrch[CoprOrch1]		0,902							
CoprOrch[CoprOrch2]		0,93							
INT[INT1]			0,898						
INT[INT2]			0,866						
INT[INT3]			0,877						

INT[INT4]	0,803						
MOT[MOT1]		0,894					
MOT[MOT2]		0,944					
MOT[MOT3]		0,93					
MOT[MOT4]		0,906					
OP[OP1]			0,842				
OP[OP2]			0,798				
OP[OP3]			0,847				
OP[OP4]			0,815				
ORCH[ORCH1]				0,873			
ORCH[ORCH2]				0,861			
ORCH[ORCH3]				0,932			
ORCH[ORCH4]				0,944			
STR[STR1]							0,891
STR[STR2]							0,865
STR[STR3]							0,882
STR[STR4]							0,874
ScaleStretch[ScaleStretch1]					0,905		
ScaleStretch[ScaleStretch2]					0,885		
ScaleStretch[ScaleStretch3]					0,935		
Sensing[Sensing1]						0,753	
Sensing[Sensing2]						0,66	
Sensing[Sensing3]						0,659	
Sensing[Sensing4]						0,757	
Sensing[Sensing5]						0,858	
Sensing[Sensing6]						0,806	

9.3. Cross loadings

Cross Loadings	Concep	CoprOrch	INT	MOT	OP	ORCH	ScaleStretch	Sensing	STR
Concep[CONCEP1]	**0,896**	0,634	0,607	0,592	0,599	0,516	0,465	0,733	0,654
Concep[CONCEP2]	**0,873**	0,508	0,543	0,527	0,388	0,435	0,396	0,564	0,526
Concep[CONCEP3]	**0,836**	0,457	0,459	0,419	0,414	0,535	0,59	0,551	0,475
CoprOrch[CoprOrch1]	0,449	**0,902**	0,582	0,468	0,452	0,506	0,408	0,553	0,576
CoprOrch[CoprOrch2]	0,668	**0,93**	0,611	0,469	0,52	0,58	0,503	0,617	0,687
INT[INT1]	0,639	0,6	**0,898**	0,622	0,548	0,61	0,501	0,662	0,727
INT[INT2]	0,466	0,555	**0,866**	0,563	0,511	0,474	0,376	0,545	0,659
INT[INT3]	0,466	0,576	**0,877**	0,583	0,522	0,521	0,393	0,633	0,663
INT[INT4]	0,55	0,509	**0,803**	0,629	0,555	0,637	0,353	0,589	0,577
MOT[MOT1]	0,527	0,417	0,624	**0,894**	0,427	0,482	0,189	0,458	0,427
MOT[MOT2]	0,528	0,44	0,643	**0,944**	0,425	0,521	0,19	0,46	0,455
MOT[MOT3]	0,547	0,458	0,617	**0,93**	0,503	0,518	0,22	0,451	0,501
MOT[MOT4]	0,573	0,546	0,666	**0,906**	0,491	0,47	0,31	0,532	0,594
OP[OP1]	0,35	0,404	0,399	0,295	**0,842**	0,348	0,344	0,489	0,521
OP[OP2]	0,521	0,469	0,522	0,424	**0,798**	0,459	0,353	0,54	0,504
OP[OP3]	0,415	0,44	0,56	0,455	**0,847**	0,431	0,332	0,544	0,514
OP[OP4]	0,506	0,444	0,557	0,482	**0,815**	0,442	0,428	0,606	0,608
ORCH[ORCH1]	0,541	0,555	0,487	0,449	0,446	**0,873**	0,304	0,589	0,577
ORCH[ORCH2]	0,517	0,466	0,647	0,475	0,437	**0,861**	0,316	0,591	0,624
ORCH[ORCH3]	0,521	0,579	0,661	0,529	0,485	**0,932**	0,384	0,624	0,653
ORCH[ORCH4]	0,489	0,55	0,561	0,497	0,474	**0,944**	0,383	0,591	0,602
STR[STR1]	0,549	0,595	0,627	0,468	0,634	0,508	0,474	0,667	**0,891**
STR[STR2]	0,516	0,653	0,639	0,478	0,589	0,592	0,481	0,664	**0,865**
STR[STR3]	0,611	0,574	0,682	0,408	0,535	0,629	0,465	0,659	**0,882**
STR[STR4]	0,572	0,614	0,737	0,554	0,534	0,656	0,452	0,642	**0,874**
ScaleStretch[ScaleStretch1]	0,439	0,431	0,429	0,162	0,376	0,353	**0,905**	0,531	0,503
ScaleStretch[ScaleStretch2]	0,531	0,431	0,422	0,243	0,387	0,351	**0,885**	0,645	0,451
ScaleStretch[ScaleStretch3]	0,541	0,501	0,445	0,275	0,44	0,346	**0,935**	0,583	0,501

Sensing[Sensing1]	0,49	0,367	0,568	0,385	0,531	0,422	0,554	**0,753**	0,528
Sensing[Sensing2]	0,413	0,227	0,373	0,27	0,461	0,368	0,309	**0,66**	0,503
Sensing[Sensing3]	0,396	0,274	0,422	0,136	0,39	0,414	0,673	**0,659**	0,492
Sensing[Sensing4]	0,586	0,561	0,515	0,408	0,507	0,464	0,509	**0,757**	0,541
Sensing[Sensing5]	0,69	0,669	0,659	0,567	0,597	0,641	0,463	**0,858**	0,663
Sensing[Sensing6]	0,598	0,671	0,605	0,499	0,489	0,63	0,426	**0,806**	0,636

9.4. HTMT

HTMT	**Concep**	**CoprOrch**	**INT**	**MOT**	**OP**	**ORCH**	**ScaleStretch**	**Sensing**	**STR**
Concep									
Coproducing	0,734								
Interconnect	0,712	0,768							
Motivation	0,664	0,581	0,762						
Operational_	0,637	0,641	0,715	0,561					
Orchistational	0,650	0,685	0,719	0,581	0,576				
ScaleStretch	0,642	0,583	0,53	0,268	0,507	0,423			
Sensing	0,831	0,74	0,8	0,562	0,78	0,739	0,747		
Stategic	0,731	0,807	0,85	0,585	0,746	0,744	0,595	0,856	

9.5. Inner VIF

Inner VIF	**Alignment Competencies**	**Dynamic Capabilities_**
Alignment Competencies		2,876
Dynamic Capabilities_ Interconnect Moderating Effect Interconnect		3,697
		2,541
Moderating Effect Motivation		2,586

Motivation		2,316
Operational_	1,766	
Orchistational	1,886	
Stategic	2,428	

9.6. R2 coefficient of determination

R2	R Square	R Square Adjusted
Dynamic Capabilities	0,682	0,658

9.7. F2 effect size

f2 effect size	DynamicCap	
Alignment Competencies	0,466	Large
Interconnect	0,035	Small
Moderating Effect Interconnect	0,003	None
Moderating Effect Motivation	0,001	None
Motivation	0	None

9.8. Path coefficients

Bootstrap	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Alignment Competencies -> Dynamic Capabilities_	0,653	0,642	0,124	5,277	0
Interconnect -> Dynamic Capabilities_	0,201	0,199	0,143	1,405	0,16
Moderating Effect Interconnect -> Dynamic Capabilities_	-0,041	-0,04	0,092	0,443	0,658
Moderating Effect Motivation -> Dynamic Capabilities_	-0,03	-0,022	0,114	0,265	0,791
Motivation -> Dynamic Capabilities_	-0,003	0,011	0,111	0,025	0,98
Operational_ -> Alignment Competencies	0,325	0,323	0,027	12,073	0
Orchistational -> Alignment Competencies	0,406	0,406	0,027	14,877	0
Stategic -> Alignment Competencies	0,424	0,426	0,03	14,186	0

9.9. Outer weights

Outer Weights	**Original Sample (O)**	**Sample Mean (M)**	**Standard Deviation (STDEV)**	**T Statistics (|O/STDEV|)**	**P Values**
INT[INT1] <- Interconnect	0,33	0,333	0,027	12,044	0
INT[INT2] <- Interconnect	0,265	0,264	0,02	13,433	0
INT[INT3] <- Interconnect	0,287	0,286	0,017	16,654	0
INT[INT4] <- Interconnect	0,277	0,277	0,025	10,954	0
MOT[MOT1] <- Motivation	0,255	0,255	0,028	9,034	0
MOT[MOT2] <- Motivation	0,258	0,256	0,023	11,258	0
MOT[MOT3] <- Motivation	0,265	0,265	0,022	12,041	0
MOT[MOT4] <- Motivation	0,311	0,315	0,045	6,887	0
OP[OP1] <- Operational_	0,289	0,288	0,022	12,942	0
OP[OP1] <- Alignment Competencies	0,091	0,091	0,011	7,993	0
OP[OP2] <- Operational_	0,3	0,301	0,028	10,895	0

OP[OP2] <- Alignment Competencies	0,099	0,099	0,009	10,941	0
OP[OP3] <- Operational_	0,304	0,303	0,026	11,868	0
OP[OP3] <- Alignment Competencies	0,097	0,096	0,01	9,89	0
OP[OP4] <- Operational_	0,32	0,322	0,03	10,608	0
OP[OP4] <- Alignment Competencies	0,106	0,106	0,01	10,619	0
ORCH[ORCH1] <- Orchistational	0,265	0,265	0,017	16,036	0
ORCH[ORCH1] <- Alignment Competencies	0,109	0,109	0,01	10,538	0
ORCH[ORCH2] <- Orchistational	0,269	0,27	0,02	13,685	0
ORCH[ORCH2] <- Alignment Competencies	0,109	0,109	0,012	8,949	0
ORCH[ORCH3] <- Orchistational	0,29	0,29	0,014	20,506	0
ORCH[ORCH3] <- Alignment Competencies	0,118	0,118	0,009	13,777	0
ORCH[ORCH4] <- Orchistational	0,282	0,282	0,01	26,889	0
ORCH[ORCH4] <- Alignment Competencies	0,114	0,114	0,008	15,003	0
STR[STR2] <- Stategic	0,284	0,284	0,012	23,915	0
STR[STR2] <- Alignment Competencies	0,121	0,121	0,01	11,585	0
STR[STR3] <- Stategic	0,286	0,287	0,015	19,11	0
STR[STR3] <- Alignment Competencies	0,121	0,122	0,01	11,698	0
STR[STR4] <- Stategic	0,288	0,288	0,012	23,939	0
STR[STR4] <- Alignment Competencies	0,121	0,121	0,009	13,504	0
STR[STR1] <- Stategic	0,281	0,281	0,01	27,485	0
STR[STR1] <- Alignment Competencies	0,12	0,12	0,009	12,624	0

9.10. Significance of total effects

Significance of total effect	Total effect	T value	P Value	Significant
Alignment Competencies -> Dynamic Capabilities_	0,653	5,277	0	Yes
Interconnect -> Dynamic Capabilities_	0,201	1,405	0,16	No
Moderating Effect Interconnect -> Dynamic Capabilities_	-0,041	0,443	0,658	No

Moderating Effect Motivation -> Dynamic Capabilities_	-0,03	0,265	0,791	No
Motivation -> Dynamic Capabilities_	-0,003	0,025	0,98	No

9.11. Blindfolding - Q2

Construct Crossvalidated Redundancy

Q2 included	SSO	SSE	Q^2 (=1-SSE/SSO)	**Q2 excluded**	SSO	SSE	Q^2 (=1-SSE/SSO)
Alignment Competencies	840	377,924	0,55	Dynamic Capabilities_	70	34,389	**0,509**
Dynamic Capabilities_	70	29,156	**0,583**	Interconnect	280	280	
Interconnect	280	280		Motivation	280	280	
Moderating Effect Interconnect	70	70					
Moderating Effect Motivation	70	70					
Motivation	280	280					
Operational_	280	280					
Orchistational	280	280		**Calculate Q2 effect**	**0,177458**		
Stategic	280	280					